WHAT IS CLAIMED IS:

1. A system for effectively performing an image data transformation procedure, comprising:

an electronic camera device configured to capture primary image data corresponding to a photographic target; and

a transformation manager configured to convert said primary image data into secondary image data by utilizing transformation parameters that are optimized to minimize noise characteristics in said secondary image data.

2. The system of claim 1 wherein said primary image data is in an RGB format that is converted into said secondary image data in a YCbCr format by said transformation manager during said image data transformation procedure.

3. The system of claim 2 wherein said transformation manager performs said image data transformation procedure by utilizing said transformation parameters that include a first transformation parameter "k1", a second transformation parameter "k2", and a combination parameter "k3".

4. The system of claim 3 wherein said transformation manager utilizes a transformation matrix to perform said image data transformation procedure, said transformation matrix having a luminance transformation row that includes said first transformation parameter "k1", said second transformation parameter "k2", and a third transformation parameter that is equal to 1 minus said first transformation parameter "k1" minus said second transformation parameter "k2".

5. The system of claim 4 wherein said transformation manager calculates a first luminance value "Y1" according the a formula:

$$Y1 = (k1)R + (k2)G + (1 - k1 - k2)B$$

where "R", "G", and "B" are respective red, green, and blue color primary values from said primary image data, "k1" is said first transformation parameter, "k2" is said second transformation parameter, and (1 - k1 -k2) is a third transformation parameter from said luminance transformation row of said transformation matrix.

6. The system of claim 2 wherein said transformation parameters are optimized by evaluating an optimization metric.

7. The system of claim 6 wherein said optimization metric is evaluated in a linear L*a*b* color space to minimize said noise characteristics in said secondary image data.

8. The system of claim 7 wherein standard noise deviations above and below an average L* value are calculated for each color patch from a representative patch set, said standard noise deviations being utilized to calculate noise variance values for each of said color patches according to a formula:

$$NV = (SND)^2$$

where SND is one of said standard noise deviations, and NV is a corresponding one of said noise variance values used to calculate said optimization metric.

9. The system of claim 8 wherein said optimization metric is calculated by taking an average of said noise variance values for each color patch according to a formula:

$$\Phi \text{ (gain, illuminant, k1, k2, k3)} = (NV_1 + NV_2 + NV_3 + \ . \ . \ . \ NV_M) / \ M$$

where "M" is a total number of said color patches in said patch set, "NV" is one of said noise variance values, and "Φ (gain, illuminant, k1, k2, k3)" is said optimization metric for particular values of a camera gain, an illuminant, and a selection of said transformation parameters "k1", "k2", and "k3".

10. The system of claim 5 wherein said combination parameter "k3" is utilized to determine a combination ratio for combining said first luminance value "Y1" and a second luminance value "Y2" to produce a final luminance value "Y" for said secondary image data in said YCbCr format.

11. The system of claim 10 wherein said second luminance value "Y2" is a simple unprocessed average of selected primary color values from said primary image data.

12. The system of claim 11 wherein said transformation manager calculates said final luminance value "Y" by applying a formula:

$$Y = (k3)Y1 + (1 - k3)Y2$$

where "Y1" is the said first luminance value calculated using said transformation matrix, "Y2" is said second luminance value, and "k3" is said combination parameter.

13. The system of claim 3 wherein said transformation parameters are optimized and stored in parameter lookup tables in said camera device for each illuminant at each camera gain.

14. The system of claim 13 wherein said parameter lookup tables are implemented in a minimized format with a reduced number of said transformation parameters, said transformation manager utilizing interpolation techniques to interpolate additional transformation parameters for certain of said camera gains and said illuminants that are not specifically listed in said parameter lookup tables.

15. The system of claim 3 wherein said transformation parameters are restricted by parameter limits in which said first transformation parameter "k1" is limited according to a first formula: $0 \leq k1 \leq 1$, said second transformation parameter "k2" is limited according to a second formula: $0 \leq k2 \leq 1$, said third transformation parameter $(1 - k1 - k2)$ is limited according a third formula: $0 \leq (1 - k1 - k2) \leq 1$, and said combination transformation parameter "k3" is limited according to a fourth formula: $0 \leq k3 \leq 2$.

16. The system of claim 1 wherein said transformation parameters are selected in an off-line design procedure in which transformation parameter limits are defined, and an optimization metric is defined for evaluating representative color patches from a patch set.

17. The system of claim 16 wherein an optimization metric is minimized for a series of desired illuminants of said representative color patches and camera gains to thereby determine which of said transformation parameters are optimal for minimizing said noise characteristics in said secondary image data.

18. The system of claim 17 wherein said transformation parameters are utilized to create parameter lookup tables in said camera device for performing said image data transformation procedure.

19. The system of claim 1 wherein said camera device measures and records a current camera gain and a current illuminant corresponding to a photographic target.

20. The system of claim 19 wherein said transformation manager accesses parameter lookup tables of said transformation parameters, said transformation manager interpolating appropriate ones of said transformation parameters depending upon said current camera gain and said current illuminant, said transformation manager then performing said image data transformation procedure with said appropriate ones of said transformation parameters to produce said secondary image data.

21. A method for effectively performing an image data transformation procedure, comprising the steps:

capturing primary image data corresponding to a photographic target by utilizing an electronic camera device; and

utilizing a transformation manager to convert said primary image data into secondary image data by using transformation parameters that are optimized to minimize noise characteristics in said secondary image data.

22. The method of claim 21 wherein said primary image data is in an RGB format that is converted into said secondary image data in a YCbCr format by said transformation manager during said image data transformation procedure.

23. The method of claim 22 wherein said transformation manager performs said image data transformation procedure by utilizing said transformation parameters that include a first transformation parameter "k1", a second transformation parameter "k2", and a combination parameter "k3".

24. The method of claim 23 wherein said transformation manager utilizes a transformation matrix to perform said image data transformation procedure, said transformation matrix having a luminance transformation row that includes said first transformation parameter “k1”, said second transformation parameter “k2”, and a third transformation parameter that is equal to 1 minus said first transformation parameter “k1” minus said second transformation parameter “k2”.

25. The method of claim 24 wherein said transformation manager calculates a first luminance value “Y1” according the a formula:

$$Y1 = (k1)R + (k2)G + (1 - k1 - k2)B$$

where “R”, “G”, and “B” are respective red, green, and blue color primary values from said primary image data, “k1” is said first transformation parameter, “k2” is said second transformation parameter, and (1 - k1 -k2) is a third transformation parameter from said luminance transformation row of said transformation matrix.

26. The method of claim 22 wherein said transformation parameters are optimized by evaluating an optimization metric.

27. The method of claim 26 wherein said optimization metric is evaluated in a linear L*a*b* color space to minimize said noise characteristics in said secondary image data.

28. The method of claim 27 wherein standard noise deviations above and below an average L* value are calculated for each color patch from a representative patch set, said standard noise deviations being utilized to calculate noise variance values for each of said color patches according to a formula:

$$NV = (SND)^2$$

where SND is one of said standard noise deviations, and NV is a corresponding one of said noise variance values used to calculate said optimization metric.

29. The method of claim 28 wherein said optimization metric is calculated by taking an average of said noise variance values for each color patch according to a formula:

$$\Phi\ (\text{gain, illuminant, k1, k2, k3}) = (NV_1 + NV_2 + NV_3 + \ .\ .\ .\ NV_M)/\ M$$

where "M" is a total number of said color patches in said patch set, "NV" is one of said noise variance values, and "Φ (gain, illuminant, k1, k2, k3)" is said optimization metric for particular values of a camera gain, an illuminant, and a selection of said transformation parameters "k1", "k2", and "k3".

30. The method of claim 25 wherein said combination parameter "k3" is utilized to determine a combination ratio for combining said first luminance value "Y1" and a second luminance value "Y2" to produce a final luminance value "Y" for said secondary image data in said YCbCr format.

31. The method of claim 30 wherein said second luminance value "Y2" is a simple unprocessed average of selected primary color values from said primary image data.

32. The method of claim 31 wherein said transformation manager calculates said final luminance value "Y" by applying a formula:

$$Y = (k3)Y1 + (1 - k3)Y2$$

where "Y1" is the said first luminance value calculated using said transformation matrix, "Y2" is said second luminance value, and "k3" is said combination parameter.

33. The method of claim 23 wherein said transformation parameters are optimized and stored in parameter lookup tables in said camera device for each illuminant at each camera gain.

34. The method of claim 33 wherein said parameter lookup tables are implemented in a minimized format with a reduced number of said transformation parameters, said transformation manager utilizing interpolation techniques to interpolate additional transformation parameters for certain of said camera gains and said illuminants that are not specifically listed in said parameter lookup tables.

35. The method of claim 23 wherein said transformation parameters are restricted by parameter limits in which said first transformation parameter "k1" is limited according to a first formula: $0 \leq k1 \leq 1$, said second transformation parameter "k2" is limited according to a second formula: $0 \leq k2 \leq 1$, said third transformation parameter $(1 - k1 - k2)$ is limited according a third formula: $0 \leq (1 - k1 - k2) \leq 1$, and said combination transformation parameter "k3" is limited according to a fourth formula: $0 \leq k3 \leq 2$.

36. The method of claim 21 wherein said transformation parameters are selected in an off-line design procedure in which transformation parameter limits are defined, and an optimization metric is defined for evaluating representative color patches from a patch set.

37. The method of claim 36 wherein an optimization metric is minimized for a series of desired illuminants of said representative color patches and camera gains to thereby determine which of said transformation parameters are optimal for minimizing said noise characteristics in said secondary image data.

38. The method of claim 37 wherein said transformation parameters are utilized to create parameter lookup tables in said camera device for performing said image data transformation procedure.

39. The method of claim 21 wherein said camera device measures and records a current camera gain and a current illuminant corresponding to a photographic target.

40. The method of claim 39 wherein said transformation manager accesses parameter lookup tables of said transformation parameters, said transformation manager interpolating appropriate ones of said transformation parameters depending upon said current camera gain and said current illuminant, said transformation manager then performing said image data transformation procedure with said appropriate ones of said transformation parameters to produce said secondary image data.

41. A computer-readable medium comprising program instructions for performing an image data transformation procedure by performing the steps of:

capturing primary image data corresponding to a photographic target by utilizing an electronic camera device; and

utilizing a transformation manager to convert said primary image data into secondary image data by using transformation parameters that are optimized to minimize noise characteristics in said secondary image data.

42. A system for effectively performing an image data transformation procedure, comprising:

means for capturing primary image data corresponding to a photographic target; and

means for converting said primary image data into secondary image data by using transformation parameters that are optimized to minimize noise characteristics in said secondary image data.